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ABSTRACT (Maximum 200 words)

The principal objective of this project is to develop a calibrated simulation model which can accurately predict the effects on overall phased array system performance when conventional subsystems are replaced with optically assisted subsystems. Various components of single side band (SSB) modulator have been designed and fabricated. The designs used for this task employed a commercially available microwave design software (MDS) developed by Hewlett Packard for the microwave components, while the optical modulators are fabricated using the annealed proton exchange technique. This structure was one of the most complex microwave structures on $LiNbO_3$ to date. The design of this structure requires a complexity well beyond a simple overlap integral. Therefore a real mixture of optical CAD with microwave design can be implemented.

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PROGRESS REPORT

for Office of Naval Research
for the period January 1, 1995 through June 1, 1995

1. Contract Title:

Phenomenological Modeling of Optically Assisted Phased Array Radar

Principal Investigator:

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2. Technical Objectives:

The principal objective of this project is to develop a calibrated simulation model which can accurately predict the effects on overall phased array system performance when conventional subsystems are replaced with optically assisted subsystems.

3. Approach:

The approach thus far has been to incorporate time efficient computer aided design (CAD) tools to model the entire system performance of an optically assisted phased array system. The CAD simulator will consist of three levels of phased array system analysis; a system level consisting of functional blocks, an equivalent circuit level for each of the system blocks, and a component level. Our approach has been to integrate existing phenomenological models of the separate system blocks into a computer friendly environment which can then perform an accurate overall optically assisted system performance.

4. Accomplishments:

Various components of single side band (SSB) modulator have been designed and fabricated. The designs used for this task employed a commercially available microwave design software (MDS) developed by Hewlett Packard for the microwave components, while the optical modulators are fabricated using the annealed proton exchange technique. Fabrication conditions have been experimentally determined for the prediction of single mode regimes. This is important since the single mode regime is necessary for the optical modulator to be successful. It was found that MDS was not sufficient for the prediction of actual device performance.

5. Significance:

This structure was one of the most complex microwave structures on $LiNbO_3$ to date. The design of this structure requires a complexity well beyond a simple

overlap integral. Therefore a real mixture of optical CAD with microwave design can be implemented.

6. Future Efforts:

1) Future work includes describing some anomalous resonances that we saw in the $LiNbO_3$ single sideband structure. Also, we will use electrooptic sampling and slot mode analysis on these structures.
2) Work has begun on an 'active' front end laser driver building on the work of Kuang Ki Chen entailing addressing active nonlinear structures. This requires dynamical modeling.

7. Publications and Presentations Partially Supported Under This Grant January 1, 1995 through July 1, 1995

Raghu Narayan, and Alan Mickelson, "Design and Fabrication of Single Side Band (SSB) optical Modulator," Digest Of The LEOS Summer Topical Meeting, **ThB4** pg. 34, (1995).

Paul D. Biernacki, Henry Lee, and Alan Mickelson, "Evaluation of Defect Related Diffusion in Semiconductors by Electrooptical Sampling," Accepted IEEE Journal Quantum Electronics.

P. Biernacki, D.R. Hjelme, M. Yadlowsky, A.R. Mickelson, "Electro-Optical Sampling for High Frequency Electric Circuits," in Defect Recognition and Image Processing in Semiconductors and Devices, ed. J. Jimenez, Institute of Physics Conference Series Number 135, (1994).

S. L. Kwiatkowski, A. R. Mickelson, and D. R. Hjelme, "On-axis polarization coupling in y-cut titanium indiffused lithium niobate slab waveguides," submitted to Appl. Optics.

A. R. Mickelson, "Rare Earth Integrated Optics," International Union of Radio Science, Boulder (CO), (Jan. 3-6, 1995).

A. R. Mickelson, "Rare Earth Doped Polymers," International Union of Radio Science, Boulder (CO), (Jan. 3-6, 1995).

J. Ma and A. R. Mickelson, "Optical Interconnects in VLSI Systems Using Polymer Waveguides and Switches," International Union of Radio Science, Boulder (CO), (Jan. 3-6, 1995).

R. Narayan and A.R. Mickelson, "Channel Waveguide Studies in Mg-Doped LiNbO3," International Union of Radio Science, Boulder (CO), (Jan. 3-6, 1995).

P. Biernacki, H. Lee and A.R. Mickelson, "Optical Sampling for Determination of Material Characteristics," International Union of Radio Science, Boulder (CO), (Jan. 3-6, 1995).

S. Lin and A. R. Mickelson, "Nd-Chelate-Doped Polymer Waveguides for Optical Amplifiers," International Union of Radio Science, Boulder (CO), (Jan. 3-6, 1995).

D. Tomic, S. Lin, W. Feng, and A. R. Mickelson, "What Limits Passive Directional Coupler Crosstalk," International Union of Radio Science, Boulder (CO), (Jan. 3-6, 1995).

W. Feng, R. B. Hooker and A. R. Mickelson, "Polymeric Electrooptic Devices," International Union of Radio Science, Boulder (CO), (Jan. 3-6, 1995).

8. **Participants:**

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